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Subsequent to the SI investigation of the storm drains in Parcel A, the Navy conducted maintenance activities involving cleaning out the catch basins and storm lines. The amount of sediment present in the storm drain catch basins was minimal. Sediment sampling was proposed during dry and wet seasons to confirm the effectiveness of the maintenance activities. The results of this sampling are expected to be available in late 1995.

Because of the largely nonindustrial land use of Parcel A, the presence of only small quantities of sediment in the SI-50 manholes, lack of visual or OVA evidence of significant contamination in Parcel A, and analytical result, the Parcel A SI report (PRC/HLA 1993) concludes that the Parcel A storm drain system did not contain substantial contamination.

4.5 IR-59 JERROLD AVENUE INVESTIGATION

IR-59 JAI was investigated as part of RI activities from July 1994 to May 1995 and is not described in the Parcel A SI report. The IR-59 Jerrold Avenue Investigation (IR-59 JAI) entailed investigating the occurrence of sandblast grit and pesticides in soil in a vacant lot located in the upland portion of Parcel A on Jerrold Avenue (Figure 4-14).

4.5.1 Site Description and History

The vacant lot that encompasses IR-59 JAI measures approximately 153 by 70 feet. This lot is a residential lot next to other residential lots and faces Jerrold Avenue. IR-59 JAI is located about 150 feet northeast of and downslope from Site SI-43, the Gardening Tool House (Section 4.3).

Between 1935 and 1948, four quonset huts were constructed on the IR-59 JAI lot. Utility maps indicate that these quonset huts were serviced by a sanitary sewer connected to Inner Avenue (Navy 1950). Aerial photographs taken in 1977 show that the quonset huts had been removed. Between 1981 and 1983, temporary structures were constructed on the lot. Aerial photographs from 1981 do not show these structures, but they are visible in aerial photographs taken in 1983. An aerial photograph taken in 1989 shows that the temporary structures had been removed. Currently, the site consists of a vacant lot covered with vegetation and both intact and broken asphaltic walkways that once led to the quonset huts and temporary buildings. A plywood shed was located on the northeast end of the lot, and the southeast boundary of the lot is a retaining wall. The outlines of the six structures formerly located at the lot, the location of the former plywood shed and retaining wall, and the approximate location of the sanitary sewer lines are shown on Figure 4-15.

In 1994, after excavating a test pit to evaluate a geophysical anomaly for the IR-59 groundwater investigation discussed in Section 5.0, a backhoe inadvertently drove over and broke a shallow water line. While the water line was being repaired, the PWC discovered sandblast grit waste with paint chips in the backfill of the utility trench of a sanitary sewer line. The grit consisted of black, granular particles commonly referred to as "black beauty" and was generally composed of crushed and graded coal slag.

Paint chips were visible in the IR-59 JAI sandblast grit, and heavy metal contamination has been detected in the spent sandblast grit at other HPA sites. Therefore, one sample, sample IR59SS02, was collected of the sandblast grit. This sample was composed of mixed sandblast grit and soil at the ground surface near the water line and was analyzed for CLP SOCs, CLP pesticides and PCBs, TPH as diesel fuel and as motor oil, TRPH, and metals.

Analytical results indicated the presence of 4,4'-DDT at 13,000 μg/kg; 4,4'-DDD at 8,100 μg/kg; and 4,4'-DDE at 1,600 μg/kg for a total concentration of 4,4'-DDT; 4,4'-DDD; and 4,4'-DDE of 22,700 μg/kg (22.7 mg/kg). Low levels of alpha-chlordane at 26 μg/kg and gamma-chlordane 25 μg/kg were also detected.

SOCs were also detected in the sample but at levels below the associated EPA Region IX PRGs with the exception of benzo(a)pyrene, which was detected at 160 μg/kg. TPH as diesel fuel and as motor oil were detected at 47,000 and 190,000 μg/kg, respectively, and TRPH was detected at 80,000 μg/kg. Metals were also detected above HPALs.

Because initial analysis of the sandblast grit detected elevated levels of pesticides and because preliminary investigation of the area indicated that sandblast material was used as backfill for the utility trench and may have been associated with the pesticide and metal contamination in the soil, a work plan for an investigation of IR-59 JAI was developed. Because analytical results detected TPH as motor oil in soil, TPH as motor oil in soil at IR-59 JAI was further investigated because TPH as motor oil had previously been detected in the Parcel A groundwater. Meetings were held between the Navy and regulatory agencies to define the scope and objectives of the investigation, report findings developed during the investigation, and discuss and redirect the investigation effort as site conditions became better known. The four major components to be investigated at IR-59 JAI include the following:

- **Pesticide Contamination**: Identify the nature and extent and possible source of pesticide contamination

- **Sandblast Grit**: Identify the extent of sandblast grit used as backfill for the utility trench of the sanitary sewer line and determine if sandblast is the source of pesticide contamination

- **Sanitary Sewer Line**: Map and dismantle the sanitary sewer line

- **Motor Oil**: Identify the nature and extent of motor oil contamination and determine if the contamination is associated with TPH as motor oil discovered during the Parcel A groundwater investigation (see Section 5.0)

4.5.2 Soils and Geology

The surface and near-surface soil of IR-59 JAI consists of disturbed soil and fill, undisturbed native soil, and weathered bedrock. Serpentinite and possibly graywacke bedrock of the Franciscan Complex underlie these soils at a shallow depth. Bedrock is not exposed at the ground surface within the site. Each of the soil and rock types encountered are described below and presented in Figure 4-16.

The disturbed soil and fill (Figure 4-16, symbol A) appears to have been derived largely from the underlying undisturbed native topsoil. The disturbed material is typically a layer of dark brown clayey or silty sand 1 to 1.5 feet thick. Although compositionally similar to the underlying soil, the disturbed soil contains fragments of debris such as asphalt fragments, nails, lumber, and glass and appears noticeably less compact than deeper soils. These soils are probably the result of fill placement and disturbances related to the construction of building foundations, utility trenching, or minor site grading.

The undisturbed native soil (Figure 4-16, symbol B) is the product of deep weathering of the underlying soil and bedrock. This soil horizon has been altered by vegetation and burrowing activity, resulting in soil mixing and relatively high organic matter content. These soils are commonly dark brown to yellow brown and are composed of abundant clay and silty sand. The undisturbed soils are present to about 3 feet bgs.

Weathered bedrock (Figure 4-16, symbol C) is present immediately above bedrock and typically under the undisturbed native soil. Weathered bedrock results from decomposition of the parent bedrock but still retains some of its fabric and compositional characteristics. Weathered bedrock in the lot is typically olive colored, indicating that the parent rock is serpentinite. The bedrock reportedly varies in composition from clayey sand with gravel to fat clay (clay of relatively high plasticity). Weathered bedrock is typically 1 to 2 feet thick.

Deeply weathered and sheared serpentinite bedrock is located at 4 to 5 feet bgs. In the southern portion of IR-59 JAI, soils are noticeably more granular and lighter brown in color, suggesting that the underlying bedrock in this area may include graywacke or shale.

4.5.3 Method of Investigation

Investigation by excavation of pesticide-contaminated soils and sandblast grit was used to identify and characterize potential contaminants at the site. A backhoe was used to excavate soil suspected of being contaminated or visually stained. Soil samples were then collected and analyzed to determine if further characterization was necessary. Because 4,4'-DDT and its degradation products 4,4'-DDD and 4,4'-DDE are the primary COCs for IR-59 JAI, field testing for this family of pesticides was used to determine the appropriate extent of the characterization. The source area evaluation, soil sampling activities, excavation activities, and analytical programs associated with IR-59 JAI are discussed below.

Source Area Evaluation

The following potential source areas were evaluated to determine their association with the pesticide contamination: the sandblast grit associated with the sanitary sewer line, the plywood shed, and the retaining wall. These sources are discussed below.

Sandblast Grit Associated with Sanitary Sewer Line

A preliminary investigation indicated that sandblast grit was used as backfill material for a portion of the sanitary sewer line. To evaluate the extent of the sandblast material, the configuration of the sanitary sewer line was mapped by geophysical method (Figures 4-14 and 4-15).

A main sanitary sewer pipe was located at the IR-59 JAI lot at 2 to 4.5 feet bgs. The sewer line at the IR-59 JAI lot drains north, with five lateral lines connecting to the main sewer line (three west lateral stations at 30, 65, and 110 feet; and east lateral stations at 30 and 110 feet). The sewer line beneath Jerrold Avenue is located at approximately 6.5 feet bgs. Sewage from Jerrold Avenue does not drain toward the sewer lines in the IR-59 JAI lot because the sewer line beneath Jerrold Avenue is lower than the sewer line in the IR-59 JAI lot. Sewer line locations correspond approximately to the locations shown on Navy control diagrams (Navy 1950 and undated) and are assumed to have serviced the four former quonset huts.

The west end of the lateral sewer line station at 65 bgs coincided approximately with the west wall of the former temporary building (after 1977); however, no vertical lines were discovered during the investigation that would have connected to a building. After the sewer line was dismantled during the investigation, the north end of the sewer line was plugged with concrete where it exited the IR-59 JAI lot. The plug was installed to prevent water infiltration into the sewer line.

Plywood Shed

A crude plywood shed located next to the fence at the northeast end of the lot associated was identified at the time of the water line repair (Figure 4-15). The former use of the shed is uncertain; however, an empty "Chem-Gro" can was observed within the enclosure during the investigation.

This observation suggests that household garden supplies, such as fertilizers, pesticides, herbicides, and garden tools, may have been stored in the plywood shed and used in the vicinity of IR-59 JAI. The shed and "Chem-Gro" can were removed during the investigation.

Retaining Wall

Along much of the southeast boundary of the IR-59 JAI is a 3-foot-high retaining wall with eight weep holes at its base (Figure 4-15). The weep holes are constructed of 2-inch-diameter metal pipe spaced at approximately 10-foot intervals. Surface runoff from off-site areas such as SI-43 is a potential source for total DDT residues from the front of the retaining wall and in the weep holes indicate the presence of total DDT. The highest concentrations were detected in the weep holes. Total DDT was not detected in the southeast side of the retaining wall at the depth of the weep holes. As a result, the distribution of total DDT indicates that pesticides were directly applied to the weep holes and surrounding areas rather than resulting from migration from off-site sources.

Soil Sampling Activities

Approximately 339 soil samples were collected at the ground surface to 5.5 feet bgs at IR-59 JAI to characterize the lateral and vertical extent of soil contamination and to verify that soil excavation activities were adequate. Soil samples were collected from the sandblast grit and in the soils surrounding the sanitary sewer line, areas next to the sanitary sewer line, and at the base of the retaining wall. Sampling locations are shown in Figures 4-17, 4-18, and 4-19 and the test pit logs are shown in Appendix A (Pages A-24 through A-29).

Excavation Activities

Material was excavated and resampled for confirmation, whenever field testing detected pesticide concentrations at or exceeding the detection limit of 0.2 mg/kg in backfill or soil samples. Soil excavation and resampling continued until field testing detected total DDT at concentrations of less than 0.2 mg/kg.

Sandblast Grit and Sanitary Sewer Line

Investigation of the sandblast grit and associated sewer line included excavating three test pits, excavating one trench, and sampling unused sandblast grit.

To provide access for sewer line mapping and to collect subsurface materials near the sanitary sewer line for analysis, test pits IR59TA05, IR59TA06, and IR59TA07 were excavated (Figures 4-17 and 4-18). Soil from the test pits was placed on plastic sheeting next to the respective test pit and later moved into the street before being transported to an off-site facility. Sandblast grit from the sidewall of test pit IR59TA05 was collected and analyzed (sample 9431H605). Two soil samples, samples 9431H306 and 9431H604, respectively, were collected from test pit IR59TA07 to compare pesticide levels in soil above and below a leaky sewer line coupling near the point where the sewer line exited the lot. The test pit logs are provided in Appendix A.

Trench IR59TA08 was excavated to delineate and dismantle the sanitary sewer line. Soils containing the pesticide contamination and associated sandblast grit were also excavated. The trench length totaled 120 lineal feet and typically extended from 0.5 to 1.0 foot below the bottom of the sanitary sewer line. Soil from the trench was stored on plastic sheeting next to the trench before it was moved to Jerrold Avenue in preparation for transport off-site to an appropriate disposal facility. The ends of the trench were also surveyed. At its north end where the sewer line continued off site, the line was plugged with concrete. Trench IR59TA08 was backfilled with imported clean fill material. Soil samples were collected from the trench sidewalls and bottom, and from the pile of excavated soil (backfill samples). Sandblast materials were discovered in a localized area around the sanitary sewer connection at the east lateral station at 30 feet. The trench log is provided in Appendix A. Trench dimensions, sampling locations, and other observed soil and utility conditions are as shown in Figure 4-19.

To assess the possibility that sandblast grit may have been contaminated with pesticides before it was placed in the lot, sample IR59SB28 of the "black beauty" grit was collected from a sandblast grit storage hopper located near Dry Dock 4. Pesticides were not detected in sample IR59SB28, indicating that the pesticide-contaminated sandblast grit at IR-59 JAI was probably contaminated after it was brought on site.

Adjacent Areas

Soil was also sampled to delineate the lateral and vertical extent of pesticide contamination not necessarily associated with the sandblast grit. Before a sample was collected, loose and disturbed soil was removed from the ground surface to expose soil representing the ground surface of the IR-59 JAI lot prior to investigation activities.

Soil samples were collected to assess the distribution of pesticides in near-surface soil and to evaluate whether the pesticide initially detected in sample IR59SS02 was an isolated occurrence. Samples IR59SS03, IR59SS04, and IR59SS05 were collected from next to the repaired water line shown on Figure 4-17. The total pesticide concentrations in samples IR59SS03, IR59SS04, and IR59SS05 were 192, 19.4, and 2.9 μg/kg, respectively (Section 4.5.4). Low levels of TPH as motor oil were also detected at concentrations up to 21,000 μg/kg (Section 4.5.4).

Because pesticides were detected, the investigation of the adjacent areas broadened. Relatively shallow soil excavations of less than 36 inches bgs were completed to investigate and characterize soil containing total DDT at or above the field test kit detection limit of 0.2 mg/kg (200 μg/kg). Soil excavations continued until total DDT concentrations were below the field test kit detection limit. Final excavation depths ranged from 6 to 36 inches bgs, and the excavations were primarily located in the eastern portion of the lot as shown on Figure 4-18.

Retaining Wall

To delineate the extent of pesticide contamination at the base of the retaining wall, test pits IR59TA09 and IR59TA10 (Figures 4-17 and 4-18) were excavated on the southeast side of the retaining wall. The test pits were excavated in order to evaluate the presence of DDT residues in soil at the base of the retaining wall at the level of the weep holes. Soils excavated from the test pits were stored temporarily on plastic sheeting and then replaced in the excavation when logging and sampling activities were complete. Soil from test pit IR59TA10 was later reexcavated and removed from the site because it contained total DDT residuals at a concentration of 0.5 mg/kg (laboratory analysis) in test pit spoils (sample IR59SS24). Samples 9443G889 and 9443G890 were collected from test pit IR59TA09, and samples 9443G887 and 9443G888 were collected from test pit IR59TA10. Test pit logs are provided in Appendix A.

4.5.3.3 Analytical Program

Field screening analysis was used to (1) test soils for pesticides, specifically total DDT (the total concentration of 4,4'-DDT, 4,4'-DDD, and 4,4'-DDE; and (2) to provide a basis for real-time assessment of both the presence of total DDT and to determine the limits of the excavation. Selected field samples were sent to the laboratory for analysis to confirm and calibrate the field test results. Samples for laboratory analysis were selected to be spatially representative and representative of the range of contaminant concentrations detected by the field test kit. The types of analytical methods performed on soil samples are summarized in Table 4-21. The field and analytical results for all soil samples collected at IR-59 JAI are presented in Appendix B.

Field Screening Analysis

Soil samples were analyzed in the field with Millipore Test Kits using an immunoassay-based test method approved by EPA (EPA Test Method 4042). Of the 339 soil samples collected during the investigation, 328 were analyzed using the immunoassay kits. Calibration was performed using three total DDT standards at concentrations of 0.2, 1.0, and 10 mg/kg in soil. In addition, a negative control (reagent blank) was analyzed for each sample batch. The presence or absence of total DDT in each field sample was determined by photometric comparison with standard sample results. One sample extract was analyzed in duplicate in each batch. The detection limit of the field test kits was 0.2 mg/kg, and the results are reported in ranges of less than 0.2 mg/kg, 0.2 to 1 mg/kg, 1 to 10 mg/kg, and greater than 10 mg/kg, unless dilution was necessary. When dilution was necessary, the results were multiplied by a factor of two or three, depending on the dilution volume. The results of the field testing are compiled in Appendix B.

Laboratory Analysis

Of the 339 soil samples collected, 69 (20 percent) were sent to the laboratory for analysis. The 11 soil samples collected but not field tested were sent to the laboratory, and 58 samples were sent for confirmation analysis. Laboratory analyses included CLP SOCs on 62 samples, CLP pesticides and PCBs on 60 samples, chlorinated herbicides (using EPA method 8150) on 3 samples, TPH-extractables as motor oil on 66 samples and as diesel on 56 samples, TRPH on 1 sample, CLP metals on 60 samples, and total organic carbon (TOC) on 3 samples.

4.5.4 Nature and Extent of Contamination

This section focuses on identifying COCs using the criteria defined in Section 4.0 and discussing the nature and extent of the sandblast grit, SOC, pesticide and PCB, herbicide, TPH and TRPH, and metal contamination at IR-59 JAI. The criteria used to define COCs are discussed in Section 4.1.2.

Sandblast Grit

During the investigation, whenever sandblast grit was detected at IR-59 JAI, its lateral and vertical extent were identified and the sandblast was subsequently excavated. Sandblast grit was detected during repair of the broken water line near the intersection of the main sewer line with the east lateral station at 30 feet (Figure 4-19). The initial sample collected, sample IR59SS02, contained the highest concentrations of arsenic, copper, iron, manganese, and vanadium of all the soil samples collected from IR-59 JAI. This high level of contamination is probably due to paint chips observed in the sandblast grit.

During mapping of the east lateral station at 30 feet, a thin layer of sandblast grit was observed in test pit IR59TA05. SOCs, pesticides, TPHs, and metals were identified in sandblast grit sample 9431H605. The layer of sandblast grit extended about 6 feet laterally along the sewer line at 0.5 to 1.5 feet bgs. The presence of this thin layer of sandblast grit suggests that it was used as utility backfill.

Minor quantities of sandblast grit were observed scattered at the ground surface potentially from the backhoe scattering sandblast grit during the repair of the water line. Therefore, sandblast grit is only associated with the backfill of the utility trench at the east lateral station at 30 feet.

Semivolatile Organic Compounds

Table 4-22 summarizes the analytical results for soil samples in which SOCs were detected. Of the 62 samples analyzed for SOCs, 20 SOCs were detected in up to 17 samples, with a maximum individual contaminant concentration of 530 μg/kg for soils left in place. All samples, with the exception of sample IR59SS25, were collected from 12 to 18 inches bgs. SOCs were detected only in surface samples from less than 12 inches bgs. The only SOC for which a EPA Region IX or Cal-modified PRG was exceeded was benzo(a)pyrene (EPA Region IX PRG of 61 μg/kg), which was detected in sample IR59SS02 at 160 μg/kg. Soils associated with sample IR59SS02 were subsequently removed during excavation. After excavation, the soils remaining in place contained SOCs at concentrations ranging from not detected to 280 μg/kg. No remaining soils contained SOCs exceeding their EPA Region IX or Cal-modified PRGs.

The presence of SOCs in soils associated with samples IR59SS02 and IR59TA05 could be attributed to the presence of TPH as diesel fuel at these two locations.

Pesticides and Polychlorinated Biphenyls

Analytical results from the laboratory for soil samples in which pesticides were detected are summarized in Table 4-23. Appendix B summarizes results from the field test kit analyses. The pesticides 4,4'-DDT; 4,4'-DDD; 4,4'-DDE; aldrin; alpha-BHC; alpha-chlordane; gamma-chlordane; dieldrin; endrin; heptachlor; heptachlor epoxide; and methoxychlor were detected. PCBs were not detected in any samples.

Initial field and laboratory analyses indicate that total DDT concentrations were generally greatest in the northeastern portion of the IR-59 JAI lot near the plywood shed (Figure 4-18). The exception was at the base of the retaining wall near the eight weep holes. Subsurface soil concentrations of total DDT were slightly above 0.2 mg/kg in surface soil in (1) the northwest portion of the lot at soils associated with sample IR59SS20, and (2) beyond the northeastern lot boundary at soils associated with sample IR59SS17.

At the retaining wall, soil samples were collected from three weep holes and analyzed using field test kits. Sample 9441G866 from weep hole 1 contained total DDT concentrations of greater than 10 mg/kg. Sample 9440G842 from weep hole 2 contained total DDT concentrations of 1 to 10 mg/kg. Sample 9441G865 also from weep hole 2, contained total DDT concentrations of 10 mg/kg (Appendix B, Table B-2). Laboratory results of sample 9441G866 revealed a relatively high 4,4'-DDT concentration of 7,600 μg/kg (Table 4-23). Soil samples 9443G889 and 9443G890 from test pits IR59TA09 and IR59TA10 in the southeast side of the retaining wall contained low levels of 4,4'-DDT at 66 and 33 μg/kg, respectively. These samples were collected from the projected elevation of the weep holes 3 or 4 feet below the top of the retaining wall. Analytical results suggest that 4,4'-DDT entered the weep holes from the northwest side. The soil and debris were cleaned out of all eight weep holes along the retaining wall and the weep holes were grouted.

Based on soil sampling results, soil was excavated to about 1 foot bgs in the northwest portion of the lot in the vicinity of the location from which sample IR59SS20 was collected. Soil associated with the sewer lines and surface soil in the northeast portion of the lot and near the retaining wall was also removed to depths of up to 24 inches bgs. In the northeast part of the lot and west of the retaining wall, 4,4'-DDT was detected in samples collected to a depth of 18 inches bgs. The deepest sample, which was collected from about 3 feet bgs, indicated that 4,4'-DDT contamination was present in trench IR59TA08 at location 17 (east lateral station at 30 feet). Soil removed from areas outside the northeast lot boundary was limited to test pit IR59TA10 and adjacent areas to this test pit (Figure 4-18).

Analyses of soil from inside the sewer line near the north lot boundary at sampling location IR59SS66 revealed total DDT at concentrations less than 0.2 mg/kg (Appendix B, Table B-2). Soil samples 9431H603 and 9431H604 at test pit IR59TA07 collected from above and below the sewer line, respectively, near the line's exit from the lot contained total DDT below 0.2 mg/kg and at 0.2 mg/kg, respectively. The results indicate that the leakage from the sewer line did not contribute significant DDT contamination to surrounding soil.

Total DDT was detected at or above 0.2 mg/kg in 91 of the 328 samples analyzed using the field test kits. Laboratory analysis for pesticides on 60 samples indicate that the field test kits provided higher concentration results than the laboratory analyses. Table 4-24 compares field test kit result with laboratory results for total DDT concentrations.

As indicated in Table 4-23, laboratory analyses indicate that EPA Region IX PRGs were exceeded in four samples for 4,4'-DDT, one sample for 4,4'-DDD, and two samples for 4,4'-DDE. Soil that exceeded the field test kit detection limit was removed from all sampling locations during excavation activities as agreed upon by the regulatory agencies and the Navy, except for soil from off-site locations IR59SS17 and IR59SS73 near the northeast corner of the site (Figure 4-18). At these off-site locations, contamination was considered to be low, and EPA concurred with the decision to leave the soils in place.

When detected, aldrin, alpha-BHC, dieldrin, endrin, heptachlor, heptachlor epoxide, and methoxychlor contamination was present at depths of less than 24 inches bgs. Alpha-chlordane and gamma-chlordane were detected at depths of 36 to 48 inches bgs in test pit IR59TA09. Concentrations of these non-DDT pesticides did not exceed applicable PRGs (Table 4-23).

Herbicides

Three soil samples were analyzed for herbicides similar to those detected at SI-43, including MCPA and MCPP. Three samples were collected of the backfill removed from the water line repair area (trench IR59TA08 at sampling location 13), the soil from the bottom of trench IR59TA08 at sampling location 66, and the soil at the base of the retaining wall near the weep holes (sample IR59SS07) (Figure 4-19). Herbicides were not detected in the three samples; consequently, herbicide results are not presented in any tables.

TPHs and TRPH

Analytical results of TPHs detected in IR-59 JAI soil samples are summarized in Table 4-25. TPH as diesel fuel was detected in 2 of the 66 samples analyzed, TPH as motor oil was detected in 40 of the 66 samples analyzed, and TRPH were detected in 1 sample analyzed. PRGs have not been established for TPH as motor oil or diesel or for TRPH.

TPH as diesel fuel was detected in surface samples collected from less than 12 inches bgs. Samples IR59SS02 from 6 inches bgs and IR59TA05 from 9 inches bgs contained TPH as diesel fuel at 47 and 7.0 mg/kg, respectively.

Concentrations of TPH as motor oil ranged from 7.1 to 1,800 mg/kg. Motor oil was detected in nearly all surface soil samples analyzed at concentrations ranging from not detected to 1,800 mg/kg. Motor oil concentrations were generally highest in the upper 1 foot of soil and generally ranged from not detected to 180 mg/kg in samples from below 18 inches bgs. Motor oil was detected throughout the site and is not concentrated in any one area. No visual evidence of oil staining was observed in the samples and trenches or test pits. Because TPH is used to manufacture asphalt, its presence is possibly related to the broken asphalt walkways common throughout IR-59 JAI.

TRPH were detected in sample IR59SS02 at 6 inches bgs at a concentration of 80 mg/kg. The presence of TPH as diesel fuel in this same sample suggests that the TRPH detected may be related to diesel fuel.

Metals

Table 4-26 presents detection frequencies, ranges of detected concentrations, and analytical results for metals in soil that exceed either their HPALs for all soil types or the EPA Region IX or Cal-modified PRGs for residential soils. Metals that exceeded HPALs in one or more samples include antimony, arsenic, barium, chromium, cobalt, copper, lead, nickel, and zinc. Metals that exceeded either EPA Region IX or Cal-modified PRGs in one or more sample include arsenic, beryllium, total chromium, lead, manganese, and nickel.

Detected concentrations of antimony, barium, copper, and zinc in soils were well below EPA Region IX PRGs, and only a few of the 60 samples analyzed exceeding their HPAL. Antimony was detected in 30 samples at concentrations ranging from 0.98 to 10.7 mg/kg, well below its EPA Region IX PRG of 31 mg/kg. Sample IR59SS44 was the only sample that contained antimony at a concentration (10.7 mg/kg) that exceeded the HPAL for antimony of 9.05 mg/kg. Barium was detected in all 60 samples analyzed at concentrations ranging from 54.1 to 810 mg/kg, which are below their EPA Region IX PRG for barium of 5,300 mg/kg. Only two samples, samples IR59SS02 and IR59SS57, contained barium at concentrations (403 and 810 mg/kg, respectively) exceeding the HPAL for barium of 314.36 mg/kg. Soils associated with sample IR59SS02 were excavated as part of the investigation, thereby removing some contamination. Copper was detected in all samples analyzed at concentrations ranging from 6.2 to 1,260 mg/kg, which are well below their EPA Region IX PRG for copper of 2,800 mg/kg. Samples IR59SS02, IR59SS46, and IR59TA05 contained copper at 1,260, 222, and 609 mg/kg, respectively, which exceed the copper HPAL of 124.31 mg/kg. The highest concentration of manganese was detected in sample IR59SS02, and soils associated with sample IR59SS02 were excavated as part of the investigation activities. Zinc was detected in all samples analyzed at concentrations ranging from 25.2 to 423 mg/kg. These concentrations were all well below the EPA Region IX PRG for zinc of 23,000 mg/kg. Concentrations of zinc in 18 samples exceeded the zinc HPAL of 109.86 mg/kg.

Arsenic and beryllium were detected at concentrations exceeding the EPA Region IX PRG; however, all concentrations detected were below HPALs. Arsenic was detected in 56 of the 60 soil samples analyzed at concentrations ranging from 0.43 to 13.9 mg/kg. Although arsenic exceeded its EPA Region IX PRG of 0.32 mg/kg in all of the 56 samples, sample IR59SS02 contained arsenic at a concentration exceeding its HPAL. The soil associated with sample IR59SS02 was removed during excavation activities. Beryllium was detected in 51 of the samples analyzed at concentrations ranging from 0.24 to 0.56 mg/kg. The concentration of beryllium in all samples exceeded the EPA Region IX PRG of 0.14 mg/kg; however, all concentrations were below the beryllium HPAL of 0.71 mg/kg.

Cobalt was detected in all 60 samples analyzed at concentrations ranging from 10 to 173 mg/kg. An EPA Region IX PRG has not been established for cobalt. The HPALs for cobalt derived using linear regression equations was exceeded by cobalt concentrations in four samples from sampling locations IR59SS44 and IR59TA08 at 25, 28, and 49 feet bgs. These samples contained cobalt at concentrations ranging from 22.6 to 173 mg/kg. Soil associated with the four samples was left in place at depths of greater than 1.5 feet bgs under clean fill.

Chromium was detected in all 60 samples analyzed at concentrations ranging from 42.4 to 1,790 mg/kg. The EPA Region IX PRG of 210 mg/kg for total chromium was exceeded in 30 samples. Chromium was detected at concentrations ranging from 82 to 1,258 mg/kg in 19 of the samples analyzed. Chromium concentrations in only 7 of the 30 samples exceeded both the HPAL and EPA Region IX PRG.

Lead was detected in all 60 soil samples analyzed at concentrations ranging from 3.7 to 424 mg/kg. Lead exceeded its Cal-modified PRG of 130 mg/kg in seven of the samples. However, of these seven samples, only sample IR59SS07 contained lead at a concentration (424 mg/kg) exceeding its EPA Region IX PRG of 400 mg/kg. The HPAL for lead was exceeded in 37 samples. Six of the samples that contained lead at levels exceeding the PRG and HPAL were collected at depths of less than 1.5 feet bgs, suggesting that lead concentrations are highest in surficial fill and disturbed soil and decrease at greater depths. The soil at sampling locations where both the PRG and HPAL were exceeded was removed during excavation activities.

Manganese was detected in 59 of the 60 samples analyzed at concentrations ranging from 286 to 1,500 mg/kg. Manganese exceeded its EPA Region IX PRG of 380 mg/kg in 52 of the samples. An HPAL has not been developed for manganese. Manganese appears to be distributed laterally and vertically at similar concentrations throughout the site regardless of depth, suggesting that its presence is ambient. Manganese is commonly present in serpentinite bedrock and other Franciscan Complex materials.

Nickel was detected in all 60 of the soil samples analyzed at concentrations ranging from 41.7 to 2,928 mg/kg. Nickel exceeded its Cal-modified PRG of 150 mg/kg in 47 of the samples. The EPA Region IX PRG of 1,500 mg/kg for nickel was exceed in one sample, sample IR59SS44, which contained nickel at 2,928 mg/kg. Nickel concentrations exceeded the HPAL in 13 of the samples analyzed. Both the PRG and HPAL were exceeded in 13 of the samples. In general, the highest concentrations of nickel (exceeding both the PRG and HPAL) were detected in samples collected from the vicinity of trench IR59TA08 at depths of 1 to 2 feet bgs in the undisturbed native soil, which is derived from weathered serpentinite bedrock. The high concentrations of nickel in the soil are probably the result of weathering of the underlying serpentinite bedrock.

4.5.5 Contaminant Fate and Transport

The fate and transport of contaminants present at IR-59 JAI are directly related to the characteristics of COCs and the properties in the soil in which the contaminants are present. As described in Section 4.1.3, COCs are constituents present at levels above the EPA Region IX or Cal-modified PRGs. COCs also include TPH as motor oil detected in samples collected from soils that were either later excavated or are still in place at the site. The fate of TPH as motor oil is discussed below, along with the fate and transport for the following organic COCs: benzo(a)pyrene; 4,4'-DDD; 4,4'-DDE; and 4,4'-DDT. Arsenic, beryllium, chromium, lead, manganese, and nickel are the only inorganic COCs discussed below. Appendix D presents a more detailed discussion of the fate and transport characteristics for these COCs.

Organic Chemicals of Concern

The organic COCs at IR-59 JAI are benzo(a)pyrene; 4,4'-DDD; 4,4'-DDE; 4,4'-DDT; and TPH as motor oil. Table 4-27 summarizes the selected chemical and physical characteristics of the organic COCs in soil at IR-59 JAI. The physical characteristics of each COC and its relevance to fate and transport of COCs are discussed in Section 4.1.3. Organic COCs have high molecular weights, low water solubilities, low vapor pressures, and high K_{oc} values. Therefore, when soil has a high organic content, the organic COCs are expected to readily sorb to the soil, be highly persistent and resistant to degradation, be resistant to leaching from soil, and be constrained from directly migrating to air. Similarly, in considering TPH as motor oil in terms of the criteria for organic COCs, many of the individual constituents of motor oil mixtures have low solubilities, moderate to low vapor pressures, and high K_{oc} values. Thus, TPH as motor oil is expected to strongly sorb to soil organic matter, be resistant to leaching from soil, and be constrained from directly migrating to air.

The leaching of chemicals into underlying unsaturated soil and groundwater is insignificant because soil samples collected from test pits IR59TA05 and IR59TA07 contained relatively high levels of organic carbon (between 0.4 and 0.8 percent; see Appendix B). Organic compounds readily adsorb to the organic matter in these soils and remain bound and unavailable for leaching into groundwater because the soil K_{oc} and extremely low water solubility value. With the exception of motor oil, COCs were not detected in groundwater samples collected from nearby wells (see Section 5.0). TPH as motor oil in soil samples, however, is not associated with TPH as motor oil in groundwater. The low mobility of benzo(a)pyrene; 4,4'-DDT; 4,4'-DDE; 4,4'-DDD; and TPH as motor oil at IR-59 JAI is confirmed by the confinement of these chemicals in the surface soil to about 2 to 3 feet bgs. In addition, groundwater has been measured at a depth of approximately 70 feet bgs in the vicinity of IR-59 JAI. Migration of dissolved compounds in groundwater is not a significant pathway for the organic COCs because of the low leaching potentials and low water solubilities of the compounds and great depth to groundwater.

Migration of COCs from soil to surface water is unlikely because of the clean backfill cover. Finally, the vapor pressure of benzo(a)pyrene; 4,4'-DDD; and 4,4'-DDT are considered low because they are less than 1 x 10^{-6} mm Hg; however, 4,4'-DDE has a vapor pressure that is expected to give it a slight affinity for volatilization into the air. For TPH as motor oil, very slow volatilization is also possible. However, TPH as motor oil and 4,4'-DDE are not expected to volatilize to air from soil or wind-generated dust particles in the air because of the clean backfill cover and because VOCs are not a chemical of concern at IR-59 JAI.

Metals Chemicals of Concern

Unlike organic COCs, compound-specific fate and transport parameters are generally not applicable to metals. Sorption onto soil with high organic carbon content is the primary fate of the inorganic COCs (arsenic, beryllium, chromium, lead, manganese, and nickel) at IR-59 JAI. These metals can leach from soil and mobilize into groundwater when they are subject to a low pH of less than 4. The pH at IR-59 JAI ranges from 7.5 to 9.4 (see Appendix B). The groundwater at IR-59 JAI is located at approximately 70 feet bgs. Therefore, the potential for these metals to leach from soil to groundwater is very low because of the great depth to groundwater. Because a majority of the IR-59 JAI was excavated and backfilled with clean soil, it is unlikely that metals-contaminated soil could be transported to air by wind erosion or surface water runoff because the rate of infiltration is low.

4.5.6 Conclusions and Recommendations

Sandblast grit was observed in the immediate area of the water line repair as a thin layer of trench backfill at IR-59 JAI. Minor quantities of sandblast grit were observed scattered in the area of the water line repair and the northeast lot area within the area of the surface soil excavation. Because sandblast grit is present in limited quantities and is not widespread at IR-59 JAI, sandblast grit was probably only used locally as utility trench backfill. Sandblast grit was removed both by the backhoe and by hand wherever it was observed during the sanitary sewer line and soil excavations. The entire sanitary sewer line at IR-59 JAI was dismantled.

DDT-related pesticide residues in soils were present principally in the eastern portion of IR-59 JAI and in the sewer line trench in the general vicinity of the east lateral station at 30 feet bgs. Total DDT was detected predominantly near the ground surface to a maximum depth of approximately 24 inches bgs. Total DDT was detected in a few off-site locations at shallow depths at concentrations slightly above the field test kit detection limit of 0.2 mg/kg. These levels are within soil concentration ranges considered typical for urban areas (Carey 1979). Surface or subsurface pathways from SI-43 were not evident during the SI (that is, contaminant concentrations did not increase toward SI-43), and herbicides similar to those detected at SI-43 were not detected in samples collected from IR-59 JAI. No point source for pesticide contamination was identified; rather, pesticide residues appear to occur sporadically within IR-59 JAI, near the plywood shed, and at the retaining wall weep holes where historical surface application of pesticides may have occurred.

No apparent relationship was identified between the pesticide contamination and sandblast grit or between the pesticide contamination and the sanitary sewer lines. Although the initial discovery of pesticides coincides with the discovery of sandblast grit near the water line repair location, further sampling does not indicate a relationship between the two. Extensive soil analysis next to the sewer line also indicates no relationship between pesticide contamination and the sewer line.

Motor oil was detected at sporadic locations limited to depths of about 24 inches bgs or less. The maximum detected concentration of TPH as motor oil in soil was 1,800 mg/kg. TPH as diesel fuel was detected infrequently at a maximum concentration of 47 mg/kg and probably associated with the asphaltic walkway.

Several contaminants other than pesticides were detected at IR-59 JAI but are not COCs based on PRG and HPAL screening. SOCs based on PRG and HPAL screening were detected infrequently at depths of less than 12 inches bgs. Only one out of the 62 samples analyzed for SOCs contained SOC contamination at levels that exceed the PRG, and the soil in the area from which this sample was collected was excavated during the investigation. With the exception of arsenic, lead, and nickel, most metals concentrations did not exceed PRGs or ambient levels. Arsenic and nickel values may exceed HPALs, and manganese and magnesium were frequently detected; however, these metals are present at ambient levels at IR-59 JAI based on their frequencies of detection, the lack of soil contamination patterns indicating to surface releases and, for nickel, the presence of nickel-rich weathered serpentinite at the site.

The low levels of pesticide residues, motor oils, and metals that remain in soils at the site after excavation are likely to persist. However, based on the physical and chemical properties of these compounds and the presence of a backfill cover, no significant migration to other environmental media is expected. The potential impact to groundwater from the leaching of chemicals from contaminated soil present at the site prior to investigation is considered insignificant to negligible. Therefore, no further action is necessary at IR-59 JAI.